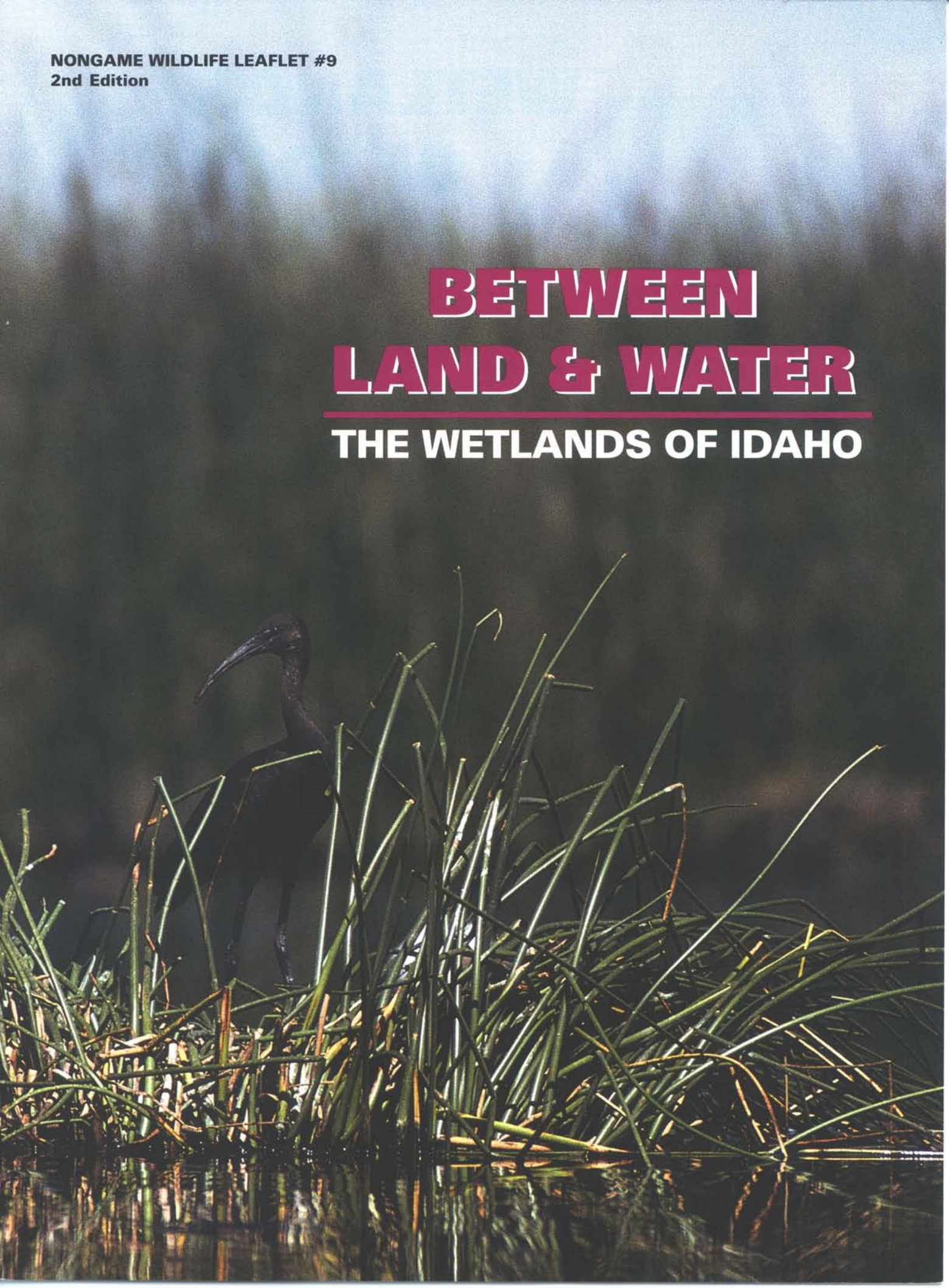
NONGAME WILDLIFE LEAFLET #9
2nd Edition

BETWEEN LAND & WATER

THE WETLANDS OF IDAHO



WETLANDS OF IDAHO

INTRODUCTION

William H. Mullins

Silver Creek is a spring-fed riparian/marsh ecosystem in southern Idaho. Since 1976, several miles of the stream and its wetlands, once threatened by nearby farming operations, have been restored by The Nature Conservancy. With less sedimentation and more vegetation, aquatic insects now abound; so do big, fast-growing fish.

Craig Groves/IDFG

Along the Upper Priest River, recommended for federal Wild and Scenic River protection, old-growth forest riparian vegetation includes western red cedar, hemlock and ferns.

(front cover) A white-faced ibis, one of many species whose range has diminished as wetlands disappear. White facial markings appear on this species during breeding season. (Market Lake Wildlife Management Area, southeastern Idaho) photo by Dave Carlson

Native Americans knew the value of wetlands long before the coming of Europeans. Wetlands, where land and water meet, produce a rich diversity of plant and animal life. In Idaho, they are often called "riparian" areas, meaning the green zone of vegetation between the water's edge and the start of upland plants such as sagebrush, grass or forest. In these lush oases, native peoples found game, shade, water and plants for food and medicine.

At least three tribes made annual treks to gather one wetland plant, camas, which has left its name on Idaho's map. Nez Perce Indians climbed steep trails from their Hells Canyon camps to harvest the nutritious roots on the Camas Prairie south and west of the Clearwater River. Shoshones and Bannocks trekked 100 miles across lava flows to another Camas Prairie below the Soldier Mountains.

Cattails were valued, too. The roots, shoots and pollen were eaten; the stems were woven into baskets and shelters. Basketmakers also used sedge roots and willow bark from wetlands. Hunters and trappers sought waterfowl, mink, muskrat, bear, deer and elk there.

Wetlands also attracted early white explorers and pioneers. From 1805 on, they followed waterways into the West, seeking new land and new dreams. Almost every Idaho stream had one or more colonies of beaver, nature's busiest wetland manufacturers. High demand for their pelts lured fur trappers by the hundreds – Fort Hall and Fort Boise were established as trading posts on major rivers. Between 1818 and 1827, nearly every beaver in Idaho was trapped. When beavers were gone, trappers were replaced by gold miners. The rush was on after 1863. Dredging and sluicing destroyed miles and miles of riparian areas, washed away in the scramble for "pay dirt."

Homesteaders crossing southern Idaho on the Oregon Trail welcomed the sight of water and followed streams where they could. They settled where water was accessible for domestic use and livestock, near rivers or, in the north, on lakeshores. Farmers began draining wetlands to grow crops on their rich soil. They built flood-control dikes, which dried up adjacent wetlands, and water-storage dams, which inundated many more.

Since the mid-1800s, Americans have systematically eliminated wetlands. Laws and government subsidies had even encouraged it. The Swamp Lands Acts of 1849, 1859 and 1860 gave 65 million acres of federal wetlands to 15 states to be reclaimed for agriculture. In the 1930s, the federal government's role in land drainage was accelerated by public works projects for flood control and irrigation.

These and other actions destroyed 53 percent of the original 221 million acres of wetlands in the lower 48 states. Approximately 58,500 acres continue to be lost each year, primarily due to urban and rural development and agriculture. Idaho has less than half its original wetlands. Most wetlands still existing have experienced some degree of degradation. Mitigation for damage to wetlands has a very poor track record because technology cannot replicate these ecosystems, particularly forested or peat wetlands.

The Clean Water Act is a broad-based law covering water pollution control. Section 404, administered by the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers, is intended to "...restore and maintain the chemical, physical, and biological integrity of the Nation's waters", which include wetlands if they meet specific criteria. Before certain kinds of development can occur on wetlands, they must be reviewed by the EPA and U.S. Fish and Wildlife Service, and the Corps

must issue them a Section 404 permit. Hydropower, highway construction and mining all require a 404 permit.

However, many activities that shift or destroy wetland functions are exempted, including indirect impacts from logging, road building, cultivated agriculture and the use of wetlands for pasture and grazing. Also, many riparian areas, which perform important wetland functions and/or have high wildlife habitat values, don't meet the Act's definition of wetlands. In general, small, isolated wetlands and those subject to drainage rather than filling aren't protected by Section 404. Examples abound. Wetlands near Boise, Ketchum/Sun Valley, Twin Falls, Coeur d'Alene and Pocatello have been lost due to urban development. A wetlands capacity to filter sediments and nutrients can be compromised by inputs from logging, road building and irrigation return flows. Many wetlands and riparian corridors on private land and public lands are used for livestock grazing. Excessive grazing by livestock changes vegetation composition and structure and reduces wetlands filtering and water storage functions.

There *are* ways to protect and restore wetlands; some are mentioned later. But first, exactly what are wetlands and why should they be saved?

Craig Groves/IDFG

Camas blooms below the Soldier Mountains at the IDFG Centennial Marsh Wildlife Management Area near Fairfield. Generations of Indians roasted and ate its bland, nutritious root. When settlers drained and planted Idaho's high prairies, camas disappeared from many sites.

WHAT IS A WETLAND?

Where there is water, there are wetlands, but despite the name, a wetland isn't always wet. In fact, it's defined by *three* components, and water (hydrology) is only one. The others are water-loving plants (called hydrophytes) and hydric soils. Water must be there long enough for these plants to exist. Thus, to recognize wetlands, you must know their plants and soils.

WETLAND PLANTS

All plants take carbon dioxide from the air and combine it with water, minerals and oxygen absorbed through their roots. Soil contains oxygen, but if soil is saturated, water replaces oxygen and the roots "suffocate." Leaves wither and fall off, roots rot and, like overwatered house plants, drowned terrestrial plants die.

Wetland plants' adaptations increase gas exchange so they can produce, use and store food under "anaerobic" soil conditions. Many woody hydrophytes grow "adventitious" roots from their stems to absorb oxygen from the air. Trees extend very wide, shallow root systems and their trunks may be swollen or buttressed for more stability. Sedges have two root systems: shallow roots for flood times and a taproot for hot, dry months. Other plants grow aerenchyma, a spongy, cork-like tissue, in their roots and stem that transports oxygen from the air when the soil is flooded. Wetland plants also "exhale" oxygen, which protects them from toxic concentrations of iron and manganese.

Another survival technique is asexual reproduction: The parent plant sends out shoots instead of making seeds. Cottonwoods and willows can be surrounded for several feet by shoots. The underground connection feeds the young plants during very wet periods, when they are vulnerable.

Bob Moseley/IDFG

Reddish iron leaches from soil at Iron Bog Research Natural Area.

HYDRIC SOILS

Wetland soils differ greatly from upland soils. They occur in frequently submerged areas, such as river floodplains, or in low-lying spots with poor drainage near lakes or ponds. They also are found where hardpan or bedrock restricts drainage. The two major types of hydric soils are organic and mineral.

Organic soils – A dense layer of organic material, sometimes called peat, indicates a hydric soil. Peat forms when moss, plants or animals die and build up without breaking down, since oxidation cannot occur in water-saturated soils. Peat moss, used in gardening, is an organic hydric soil.

Mineral soils – Hydric mineral soils are saturated for seven days or more during the growing season and are composed mostly of mineral material. To tell if a soil is hydric when water isn't there, scientists use a color chart to determine soil color. Hydric soils are usually gray, black or washed-out; upland soils are rusty red or orange. That's because soil turns red when oxygen and iron are present. If water displaces oxygen, iron doesn't oxidize—it leaches away. The presence of a "gley" layer definitely means soil is hydric. Gleyed soil contains white, green or blue clay or silt that looks like a layer of frosting. It only exists when oxygen is absent most of the year and iron is leached away by the present water.

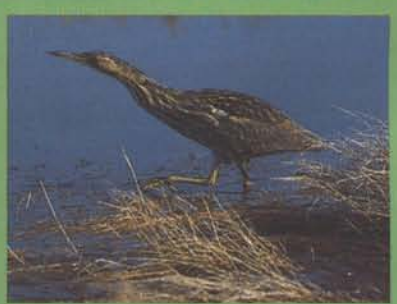
If the water table fluctuates, as it does in most of Idaho's riparian wetlands, the soil is usually mottled and may be hydric. The determining factors are the size and number of mottles and the soil color (red or gray), which reflect the duration of saturation. Light gray mineral soils with reddish-brown or yellow mottles are hydric.

"Edge effect:" Diverse types and heights of marsh plants attract a variety of wildlife.

Yellow-headed blackbird: A male postures in defense of his marsh nesting territory.

Mud Lake WMA: This Snake River Plain basin catches snowmelt from the Centennial Range.

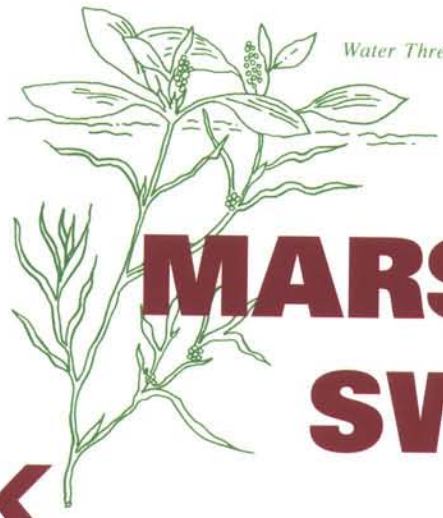
Beaver: Its dams create wetland habitat by slowing water and flooding uplands.



American bittern: Seldom seen, its strange evening call sounds like an old pump.

Sedge: Three to 12 species can be found in any marsh; some 4,000 exist worldwide.

Sandhill crane chick: Marshes are critical nesting sites for waterfowl.



Water Thread Pondweed

MARSHES & SWAMPS

Kinds of Wetlands – The major distinction between wetland systems is their stability. The most dynamic – marshes and riparian areas – are often associated with flowing water, such as streams or rivers, and they frequently flood. Ephemeral wetlands (vernal pools and potholes) hold water for a few weeks or months, even years, but eventually dry up for awhile. Peatlands, which take hundreds or even thousands of years to form, are the most stable.

All wetlands, however, are constantly changing. Within the context of water movement, the vegetation community is always being altered. Islands wash away and form again elsewhere; young willows on active channels are replaced by large cottonwood trees on older river terraces. Whole channels are cut off, becoming oxbow lakes. As the land's structure, water saturation and soil composition change, so do the kinds of plants growing on it, and plant diversity breeds wildlife diversity. Everything is interrelated. In wetland systems, transformation can be quick and dramatic or slow and subtle, but it is always happening.

Wetlands with flowing water are called *marshes* or *swamps*.

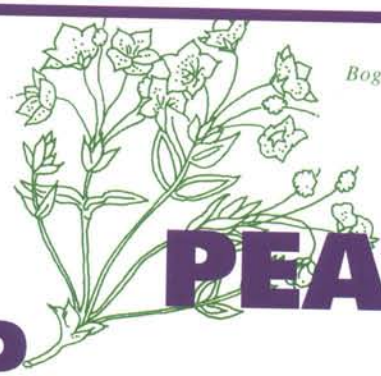
Marshes—Oxford Slough, Gray's Lake and much of Harriman State Park in eastern Idaho, and Rose Lake in northern Idaho are freshwater marshes. They are characterized by grass-like vegetation – rushes, sedges, cattails and grasses – growing in depressions or next to lakes or rivers. Grasses wave in the breeze, sunlight sparkles off the water and red-winged blackbirds call. At Gray's Lake National Wildlife Refuge, in spring and summer the cries of sandhill cranes can be heard echoing across the marsh.

Swamps—Unlike marshes, swamps are dominated by woody vegetation: cottonwood, willow, red-osier dogwood, hawthorn, river birch and alder. In Idaho, "riparian area" is a more common term for them. Riparian corridors line many waterways, offering critical resting and feeding stopovers for migratory birds. Their shade moderates stream temperatures; insects drop for hungry fish to swallow. Deer, elk and bear feed, drink and rest along them. Fish-eating birds like osprey and heron nest in riparian areas; otter, muskrat and mink den in the banks; raccoon, fox and skunk forage in the foliage; and pheasant and grouse seek cover and food there.

Photo credits: Sedge (background): Mabel Jankovsky-Jones; Mud Lake WMA: Dave Carlson; Edge effect, Sedge: John Baker; blackbird, crane: William H. Mullins; bittern: Ron Spomer; beaver: W.E. Melquist/IDFG

Lava Butte: Slowly filling a cirque watered by snowmelt, sphagnum has dammed off pools.

Narrowleaf sundew: Insects stick to "dew," then the leaf bends to place them in its "stomach."



Bog Laurel

PEATLANDS

Peatlands are magical, ancient places. Peatlands are wetlands where accumulation of organic matter exceeds decomposition due to saturated conditions. The organic soils may develop from undecomposed grasses, sedges, reeds and/or mosses. Peatlands provide habitat for plant species that are specifically adapted to extreme environmental conditions and are archives to the past.

Peatlands include fens that can be categorized based on the kind of organic matter that accumulates, water chemistry and availability of nutrients. Poor fens are sometimes referred to as "bogs". Extremely acidic, the pH of a poor fen can be as low as 4.0 (drinking water has a pH of 7.0) and is very low in nutrients. In fact sphagnum moss is sterile enough to dress wounds, and Native Americans used it to diaper babies. Many cultures eat cranberries and blueberries, which thrive in the acid environment. To survive in poor fens, plants must be very specialized. The acid soil contains little nitrogen or phosphorus. To compensate, some plants – (sundews and bladderworts) capture insects to absorb nitrogen, while cranberries, Labrador tea and bog laurel close pores in their leathery leaves and stems when their roots have no oxygen, holding in gases so they don't wither.

Intermediate fens have organic sedge peat soils and are less acidic than poor fens. Intermediate fens are the most common type of peatland in Idaho. They are sometimes called "sedge fens" as the deep organic soils accumulate from undecomposed sedges, cattails and rushes. Intermediate fens should not be confused with marshes or sedge meadows, which are wetlands with mineral soils where seasonal drying allows decomposition of plant material.

Calcareous or nutrient rich fens occur in association with springs in limestone bedrock and are quite rare. Rich fens are found in broad valleys including the Birch Creek Valley in the east-central mountains and the Teton Valley in eastern Idaho. Rich fens are typically found near groundwater discharge zones where springs surface and have a very high pH (>7) and high concentrations of calcium. Vegetation corresponds to moisture and nutrient gradients. Islands of forests or shrubs may support trees such as lodgepole pine, spruce or shrubs including bog birch or bog blueberry. Wetter sites may have slightly raised hummocks with sedges, rushes and stems of cotton grass. Water tracks between vegetation hummocks are usually sparsely vegetated and may have deposits of calcium carbonate or "marl".

Peatlands are very stable with organic soils forming at the rate of one inch in 100 years. They range from 4,000 to 60,000 years old. Such slow growth makes peatlands invaluable storehouses of knowledge. From studying peat cores, scientists learn about climatic and vegetation changes over long periods of time at that site. For instance, pollen grains found in ancient bogs near Hagerman, suggest that pine\juniper forest dominated the lower Snake River Plain between 1 million and 2 million years ago.

Peatlands support the richest plant species diversity of any habitat in Idaho, while also attracting all kinds of wildlife. This diversity helps make peatlands naturally very stable, but these ecosystems can be greatly altered by minor changes in water quality or quantity. Wastewater or storm water diverted into them destroys plant communities, disintegrates peat and replaces unique bog-dwellers with exotic species. Habitat loss and restricted distribution have put several bog plants on Idaho's rare species lists. Peatlands are irreplaceable within our lifetime. No mitigation yet developed can compensate for their loss.

Photo credits: Cranberry & sundew (background), narrowleaf sundew, Three Ponds, Lava Butte: Bob Moseley/IDFG; roundleaved sundew: Michelle Stevens; frog, pond lily: Craig Groves/IDFG; dragonfly: John Baker

American avocet: This wader sweeps shallow water with its upturned bill to catch crustaceans.

Peppergrass: A thick, 5-foot-long root feeds this rare plant, keeping it green into July.

Bladderpod: Growing on the INEEL, it can take both flood and bone-dry conditions.

Great Basin spadefoot: This small nocturnal toad burrows to avoid drought and heat.

Short-billed dowitchers: Migrating shorebirds stop at Idaho mudflats to eat invertebrates.

Three Ponds: a sphagnum moss "island" floats on this Panhandle peatland, a Research Natural Area.

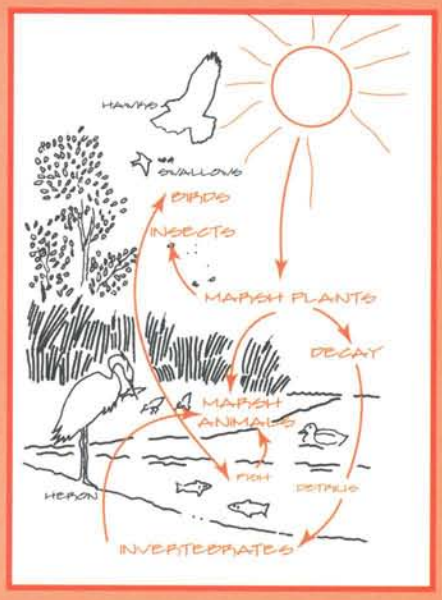
Indian pond lily: Leathery leaves float on still water, anchored in mud by long stems.

Dragonfly: From nymph to adult, huge-eyed dragonflies spend their lives close to water.

Roundleaved sundew: Nutrients from insects it digests make up for nitrogen-poor soil.

Spotted frog: Males may begin calling as early as March from slow-moving shallows.

WETLAND FUNCTIONS & VALUES



Wetlands are the fertile foundation for the transfer of energy. Plants, through photosynthesis, turn energy into tissue. It passes as food through a series of animals that eat and are eaten in turn. A single species of plant or animal participate in many food chains.

Craig Groves/IDFG

Great blue herons nest together in a "rookery" near a wetland where they can catch small fish to feed their young.

SIGNIFICANT WILDLIFE HABITAT

More than 75 percent of Idaho's wild species depend on 1 percent of the land – wetlands – during some part of their life cycle. Wetlands provide food, shelter and cover for resident and migratory species. Their bountiful and diverse plant life supports in turn a cornucopia of invertebrates, amphibians, reptiles, birds and mammals. Without wetlands, the food chain could not exist.

Several factors make wetlands, especially marshes and riparian areas, valuable to wildlife. The constant changes wrought by flowing water create "edge effect" – a mingling of plant and animal species between upland, wetlands and water. Varying vegetation height between grasses, shrubs and trees, called structural diversity, results in high wildlife diversity. Wetlands provide food, shelter and cover, but they're particularly important for breeding and nesting, when animals often are most vulnerable and need protection.

FISH HABITAT

Fish need food and shelter also. When vegetation grows next to and over streams, it shades and cools the water. Insects drop from plants into hungry mouths below and downstream. Roots secure banks, reducing siltation that covers spawning gravels but allowing undercutting so fish have hiding places.

BANK STABILIZATION AND FLOOD CONTROL

Dense wetland root systems also keep banks in place when threatened by waves or flooding. Over time, well-vegetated streams naturally narrow and deepen, the water table rises and they can handle more water.

If floods occur, storm water tops streambanks and flows into neighboring wetlands until dense vegetation and flat topography slow its velocity and soil absorbs it. Without wetlands, or if rivers are straightened and channelized, flood water races with uninterrupted force that can cause property damage if it hits manmade structures.

WATER QUALITY IMPROVEMENT

The slower water moves, the less it can carry. Dense vegetation slows and filters water. Its sediment load settles out, taking with it nutrients or pollutants such as fertilizers or pesticides that it may be carrying. Plants – especially cattails and bulrushes – ingest some water-borne nutrients, and wetland soils can neutralize some pollutants.

GROUNDWATER EXCHANGE

The Big and Little Lost Rivers of east-central Idaho got their names because after flows leave the mountains, the surface water disappears into the Snake River Plain. These rivers and other streams sink into an aquifer – an underground river flowing southwest through the porous basalt. After many years (perhaps thousands), the water reappears at several places along the Snake River. Some of this water gushes, pure and clean, from the north wall of the Snake River Canyon at Thousand Springs and Box Canyon.

This process is called groundwater recharge/discharge. Although the relationship between groundwater and surface water is very complex and poorly understood, wetlands are an important link between the two.

LOW-FLOW AUGMENTATION

Wetlands store water at high-water times, then release it. This slow and continuous augmentation improves water quality and quantity for fish, wildlife, recreation and plant growth, especially during low flows or drought.

EDUCATION

Nature Centers and schools use wetlands as outdoor laboratories. The diversity and amount of plant and animal life, the physical properties of wetlands, and their interface between land and water offer excellent learning opportunities. In Idaho, Project WILD and Project WET have wetland and aquatic elements; elsewhere Adopt-a-Stream and Adopt-a-Wetland programs encourage students and others to learn how these systems function and how to manage them so they continue to thrive.

AESTHETICS

The beauty of lush, green wetland marshes, peatlands and riparian corridors is wondrous to behold. Each season is special: brilliant gold in autumn, white-and-gray tracery in winter, bright flowers in spring and deep green reflections in summer. For the ear, bird calls and frog-talk, water music and hissing foliage unmistakably say "wetland." Artists and photographers spend hours soaking it all in and translating their experience onto canvas or film.

RECREATION

People turn to wetlands for many kinds of recreation, and wildlife watching is unsurpassed. Migratory warblers and waterfowl follow riparian corridors in fall and spring. Sandhill cranes frequent Teton Valley wetlands. Rare trumpeter swans nest in the marshes of Harriman State Park. Prairie falcons and golden eagles catch updrafts along the Snake River in the Birds of Prey Area. Harlequin ducks bob on the Lochsa River's currents; river otters dive for dinner on the Salmon River. Game species attract hunters and anglers. Thousands of people combine fellowship and philanthropy by joining groups dedicated to wetland protection, from Ducks Unlimited to the Audubon Society.

TOOLS FOR WETLAND CONSERVATION

Although public awareness of the importance of Idaho's wetlands is increasing, the state's population and development pressures are growing while the resource is shrinking. Action at federal, state and local levels is necessary if wetland loss is to be halted.

Progress is being made. Hunters contribute by purchasing federal waterfowl stamps. Revenue buys and develops waterfowl habitat, often in conjunction with donations from private organizations such as Ducks Unlimited. DU has made substantial contributions to projects like Roswell Marsh near Parma, Centennial Marsh near Hill City, and Boundary Creek Wildlife Management Area near Bonners Ferry. Numerous IDFG Wildlife Management Areas statewide are devoted wholly or in part to creating or conserving wetlands, and the federal government manages eight National Wildlife Refuges and Waterfowl Production Areas in Idaho.

Economic tools and technical assistance also promote wetland preservation and conservation. Restoration or protection of wetlands on private lands may involve multiple partners and programs such as the IDFG's Habitat Improvement Program (HIP), USFWS's Partners For Wildlife Program, Natural Resource Conservation Service's Wetland Reserve Program (WRP), Ducks Unlimited, private land trusts, and many others. The Farm Security and Rural Investment Act of 2002 (Farm Bill) continues the Wetland Reserve Program and the Wildlife Habitat Incentives Program. The Wetland Reserve Program provides opportunities for farmers and ranchers to place wetlands into conservation easements and/or provides cost-share payments for wetland restoration. The Wildlife Habitat Incentives Program provides technical and financial assistance to landowners to develop upland, wetland, riparian and aquatic habitat areas on their property.

Bob Moseley/IDFG

Minnie Miller Falls, acquired by the Nature Conservancy, are the last free-flowing springs at Thousand Springs near Bliss.

Wetland and riparian protection is mandated on federal lands; management is improving. The IDFG cooperates with the BLM and Forest Service to fence important riparian areas and manage wetlands such as the Ted Trueblood Wildlife Area on BLM land near Grand View. Designation of Research Natural Areas or similar classifications protects federal lands with exceptional ecological values such as Iron Bog, Pony Meadows and Sneakfoot Meadows – all managed by the Forest Service.

The IDFG's Idaho Conservation Data Center has identified many ecologically significant wetlands needing protection. Acting on this need for protection, The Nature Conservancy, a private conservation organization, has obtained several wetlands, including sites at Thousand Springs near Hagerman, Formation Springs near Soda Springs, Birch Creek Fen near Leadore and Gamlin Lake near Sandpoint. Other land trusts, such as the Teton Regional Land Trust, have formed to preserve local wetlands and wildlife habitat.

In 1988, the National Wetlands Policy Forum, a group of lawmakers, industry representatives and environmentalists, made a long list of recommendations for improving the nation's wetlands. Among them was adoption of a single method of defining wetlands, which was accomplished by an agreement between EPA, USFWS, Soil Conservation Service (now the NRCS) and Army Corps of Engineers in 1989. That year, the Forum's interim goal of 'no net loss of wetlands" was adopted. Its long-term goal – increasing the quantity and quality of America's

wetlands – will only be reached if cooperation between landowners, conservation organizations and federal, state and local agencies continues, *and* if every citizen who cares about the land and its wildlife gets involved.

"It has been said that neither wilderness nor innocence can be regained once lost, and that little scraps of native wetlands can never be anything more than trivial souvenirs of a past journey. But a fragment of an original wetland is no less genuine for being only a fragment, and it is anything but trivial – especially when its diversity is compared with the homogeneity of surrounding tamelands. In the world of biology, as in the world of finance, such diversity is our only hedge against unknown and future risks."

These words, written by biologist and author John Madson, express profound regret *and* hope. Wetlands conservation is a pressing need worldwide. Let's do our part in Idaho.

Charles Peterson

Nationally, wetlands are being destroyed at the rate of an acre a minute. In Boise, thanks to the cooperative efforts of community members, landowners and government agencies, an existing wetland in Hulls Gulch was saved from development and a new wetland was created. These areas now provide educational and recreational opportunities for the public.

FURTHER READING

Wetlands (second edition), by William J. Mitsch and James G. Gosselink (Van Nostrand Reinhold Co., 1993) The best technical reference on wetlands ecology.

National Water Summary on Wetland Resources, by J.D. Fretwell, J. S. Williams and P. J. Redman. (U.S. Geological Survey Water-Supply Paper 2425, 1996) An overview of the status and knowledge on wetlands including state summaries.

Status and Trends of Wetlands in the Conterminous United States 1986 to 1997, by Thomas E. Dahl (U.S. Department of the Interior, Fish and Wildlife Service, 2000) An overview of status and trends of wetlands in the United States including wetland loss and gain.

Wetlands, by William A. Niering (The Audubon Society Nature Guides, Knopf, 1985) A field guide with 600 color photos of wetland species, species descriptions and maps.

Freshwater Marshes, Ecology and Wildlife Management, by Milton Weller (1981) Good resource information on habitat and management.

Monitoring the Vegetation Resources in Riparian Areas, by A. H. Winward (USDA RMRS GTR-47 2000) Techniques for assessing riparian health using vegetation, stream channel morphology and hydrologic characteristics.

A Citizens' Guide to Protecting Wetlands, by Jan Goldman-Carter (The National Wildlife Federation, 1989) How to use regulatory and other tools to protect a wetland. Lists federal agency contacts.

Handbook for Wetlands Conservation and Sustainability, by Christy Williams, Julie Vincentz and Karen Firehook (Save our Streams program, Izaak Walton League of America, 1996) A handbook to promote wetland stewardship by examining wetland functions and fostering wetlands protection among regulators, business interests and the general public.

Hydric Soils Guidebook, by Michelle Stevens and Rob Bursik (Washington Dept. of Ecology, 1990) Soils identification and wetland delineation for lay and professional readers.

Wild about Wetlands: An Educator's Guide, produced by Two Ducks Design C. Duckworth and S. Duckworth (Idaho Department of Fish and Game 2001). A nontechnical reference that defines wetlands and presents an overview of wetland functions.

Our National Wetland Heritage: A Protection Guide (2nd edition), by Jon A. Kusler and Teresa Opheim (Environmental Law Institute, 1997) A comprehensive general reference for promoting the protection and restoration of wetlands by local governments, private citizens, conservation organizations and landowners.

Federal Manual for Identifying and Delineating Jurisdictional Wetlands, (Federal Interagency Committee for Wetland Delineation, 1989) The official manual used by Corps of Engineers, EPA, USFWS, and NRCS to delineate wetlands.

CONTACTS

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www.epa.gov/r10earth

Natural Resources Conservation Service
9173 West Barnes Drive
Boise, Idaho 83709
(208) 378-5700
www.id.nrcs.usda.gov

United State Fish and Wildlife Service
1387 South Vinnel Way
Boise, Idaho 83709
(208) 378-5243
www.fws.gov

The Nature Conservancy
Idaho Field Office
P.O. Box 165
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www.nature.org

United States Army Corp of Engineers
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